

## Generation process of brecciated marble at Hiraodai karst, Kyushu, Japan

ISHIYAMA, Saya<sup>1\*</sup> ; ANDO, Jun-ichi<sup>1</sup> ; NAKAI, Shun'ichi<sup>2</sup> ; OTA, Yasuhiro<sup>3</sup> ; DAS, Kaushik<sup>1</sup>

<sup>1</sup>Department of Earth and Planetary Systems Science, Hiroshima University, <sup>2</sup>Earthquake Research Institute, the University of Tokyo, <sup>3</sup>Kitakyushu Museum of Natural history & Human history

Geofluid is believed to be closely related to the seismic and volcanic activities. However, the detail relationship of geofluids with seismicity and volcanic activity is not studied properly through geological observations. We have found recently the brecciated marble widely distributed at Hiraodai karst plateau, Fukuoka Pref. This brecciated marble offers unique opportunity to study the relationship between geofluid and seismicity. Here, we shall explore the generation process of this brecciated marble through geological, microstructural and geochemical methods using polarization microscope, SEM, TEM, EPMA, microthermometric and MC-ICP-MS techniques.

The marble in Hiraodai karst plateau was thermally metamorphosed due to Cretaceous Hirao granodiorite intrusion. The brecciated marble occupies about 0.7 km x 1km of area in the central part of the karst. The main results of the present study are as follows.

- 1) The brecciated marble is composed of the rock fragments with variety of sizes ranging from millimeter to meter scale, and having angular to rounded shapes.
- 2) Numerous fluid inclusions are observed in the thin section of the brecciated marble.
- 3) TEM observation shows that the dense tangled dislocations are formed in calcite grains of the brecciated marble.
- 4) The homogenization and freezing temperatures of the fluid inclusions are about 240 deg C and 0 deg C, respectively.
- 5) The whole-rock and mineral separates (biotite and plagioclase) of Hirao granodiorite yields Rb-Sr isochron age of 129.4 +/- 2.4 Ma. Interestingly, Rb-Sr data of the fluid inclusions also lie on the Rb-Sr isochron of Hirao granodiorite.

The above-mentioned results of 1) and 2) suggest that the brecciation occurred by fluid infiltration and that the fragments were moved and rotated at very high speed. The result 3) demonstrates that the calcite grains of the brecciated marble experienced high stress. These three results together indicate that the brecciation process might generate seismic wave. On the other hand, the results of 4) and 5) suggest that the possible origin of the fluid inclusion is the released fluid from the Hirao granodiorite magma. Therefore, the brecciation of marble distributed at Hiraodai karst plateau was probably generated by magmatic fluid from Hirao granodiorite under high stress condition at 129.4 +/- 2.4 Ma ago.

Keywords: Brecciated rock, Hiraodai karst, Hirao granodiorite, Fluid inclusion, Rb-Sr isotope